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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/564,521	01/13/2006	Chang Hae Kim	3449-0568PUS1	3470

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EXAMINER	
BOWMAN, MARY ELLEN	

ART UNIT	PAPER NUMBER
2879	

NOTIFICATION DATE	DELIVERY MODE
11/26/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com

Office Action Summary	Application No.	Applicant(s)	
	10/564,521	KIM ET AL.	
	Examiner	Art Unit	
	MARY ELLEN BOWMAN	2879	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 August 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3 and 6-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3 and 6-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments filed August 29, 2008 have been fully considered but they are not persuasive. The cited prior art reference, Park, teaches the chemical formula $Sr_{3-x}SiO_5:Eu^{2+}_x$ ($0< x \leq 1$). Specifically, Park teaches "Eu^{2+} -activated Sr_3SiO_5 yellow phosphor" (p. 1647, par. 2) with a "0.15 mol Eu^{2+} concentration" (p. 1647, par. 4). It is well known in the art that the molar portion ($x = 0.15$ in Park) of the europium is substituted into the luminescent compound in place of strontium in order to influence the intensity of emission for the compound (see Fouassier et al., USPN 4,122,349, published October 24, 1978, hereinafter referred to as "Fouassier"; col 2, lines 51-61). Therefore, the general silicate phosphor equation taught by Park is $Sr_{3-x}SiO_5:Eu^{2+}_x$, where $x = 0.15$ (which is within $0< x \leq 1$, as claimed by applicant). The same is true of Levinson, which teaches the chemical formula $Sr_{1-x}Ga_2S_4:Eu^{2+}_x$ ($0.001 \leq x \leq 1$). Specifically, Levinson teaches $(Sr,Ca,Ba)(Al,Ga)_2S_4:Eu^{2+}$ where the amount of Ca, Ba and Al is zero. Therefore, the molar amount of Sr is 1 (col 4, lines 25-32), which indicates that molar portion of europium in the luminescent compound must be less than or equal to 1, because greater than 1 would leave a negative molar portion of strontium.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

NOTE: Maeda is the English version of WO2003/032407, published April 17, 2003, cited in applicant's third IDS, which was filed on March 7, 2008.

Claims 1-3, 7-14 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maeda et al., EP 1,447,853 A1, published August 18, 2004 (hereinafter referred to as "Maeda") in view of Park et al., *Application of Strontium Silicate Yellow Phosphor for White Light-Emitting Diodes*, Applied Physics Letters, Volume 84, Number 10, published March 8, 2004 (hereinafter referred to as "Park"), and further in view of Levinson et al., USPN 6,429,583 B1, published August 6, 2002 (hereinafter referred to as "Levinson").

Regarding claims 1 and 12, Maeda teaches **a light emitting device comprising** (e.g., [0002]; "a known semiconductor light emitting device for emitting white-based light"): **a light emitting chip** (e.g., [0002]; "a near UV LED chip"); and a phosphor (e.g., [0002]; "a phosphor layer including a plurality of inorganic phosphors") **through which a first light emitting from the light emitting chip passes** (e.g., [0049]; "the phosphor layer 2 absorbs the near UV emitted by the near UV LED 1 and converts it into white-based light"), **wherein the phosphor comprises a silicate phosphor** (e.g., [0026]; "in the semiconductor light emitting device...the yellow-based phosphor is preferably a silicate phosphor") **exciting a second light having a first centered emission peak using the first light** (e.g., [0028]; "the silicate phosphor…absorbs light of a wide wavelength…and has an emission peak in a…region of 550 through 600 nm") **and a phosphor exciting a third light having a second centered emission peak using the first light** (e.g., [0023]; "a phosphor layer…for absorbing near ultraviolet emitted by the near ultraviolet light emitting diode...and the phosphor layer includes...a green-based phosphor for emitting green-based fluorescence having an emission peak in a wavelength region not less than 500 nm and less than 550 nm"; Note: The green emission peak generated by the green-based phosphor is

the second emission peak generated by the first light.). Maeda further teaches **the silicate phosphor is a yellow series** (e.g., [0026]; "the yellow-based phosphor is preferably a silicate phosphor"). Maeda fails to teach the chemical formula of the silicate and sulfide phosphors, or that the green series phosphor is a sulfide phosphor.

In the same field of endeavor of phosphors for use in light emitting diodes, Park teaches **the silicate phosphor has a chemical formula of $Sr_{3-x}SiO_5:Eu^{2+}_x$, $(0 < x \leq 1)$** (e.g., Abstract; "to develop a yellow phosphor that emits efficiently under the 450-470 nm excitation range, we have synthesized a Eu^{2+} -activated Sr_3SiO_5 yellow phosphor"; p. 1647, par. 4; "the yellow emission peaked near 570 nm until 0.15 mol Eu^{2+} concentration"). Park further teaches the luminous efficiency of the silicate phosphor with the above listed chemical formula is better than other well known yellow phosphors (Park: p. 1649, par 3; "Sr_3SiO_5:Eu developed in this work showed a higher luminous efficiency").

In the same field of endeavor of phosphors for use in light emitting diodes, Levinson teaches **the sulfide phosphor has a chemical formula of $Sr_{3-x}Ga_2S_4:Eu^{2+}$, where $0.001 \leq x \leq 1$** (e.g., col 1, lines 42-44; "the phosphor composition comprises at least one of…$SrGa_2S_4:Eu^{2+}$"; Note: The molar amount of Sr is 1-x and the molar amount of europium is x, as explained in the "Response to Arguments" section above, and therefore the value of x must be between 0 and 1, which is within applicant's claimed range). Levinson further teaches **the sulfide phosphor is a green series** (e.g., col 4, lines 33-34 and 42-44; "the green emitting phosphors preferably have peak emissions between about 500 nm and about 555 nm… [$SrGa_2S_4:Eu^{2+}$] has a peak emission at about 535-545 nm"). Levinson further teaches that the emission peak of about 540 nm of the

green sulfide phosphor serves to improve the spectral luminous efficacy of the lamp (col 4, lines 42-45).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Maeda to include the yellow phosphor from Park and the green phosphor from Levinson, because each of the phosphors taught by the secondary references provided improved luminous efficiency over the well known phosphors disclosed by Maeda. The resulting luminous efficiency of the display would therefore increase, creating an improved display with lower power consumption and better picture quality.

Regarding claim 2, Maeda, Park and Levinson teach the invention as explained above regarding claim 1, and Maeda further teaches **the first centered emission peak is in a range of 550-600 nm** (e.g., [0023]; "a yellow-based phosphor for emitting yellow-based fluorescence having an emission peak in a wavelength region not less than 550 nm and less than 600 nm").

Regarding claim 3, Maeda, Park and Levinson teach the invention as explained above regarding claim 1, and Maeda further teaches **the second centered emission peak is in a range of 500-550 nm** (e.g., [0023]; "a green-based phosphor for emitting green-based fluorescence having an emission peak in a wavelength region not less than 500 nm and less than 550 nm").

Regarding claim 7, Maeda, Park and Levinson teach the invention as explained above regarding claim 1, and Maeda further teaches **the phosphor has a particle size of $d_{90} \leq 20$ μm, 5 μm $\leq d_{50} \leq 10$ μm** (e.g., [0058]; "in the silicate phosphor…the center grain size is preferably not less than 1 μm and not more than 20 μm and more preferably not less than 2 μm and not more than 10 μm").

Regarding claim 8, Maeda, Park and Levinson teach the invention as explained above regarding claim 1, and Maeda further teaches **the light emitting chip emits blue light** (e.g., [0009]; "an inorganic LED...having an emission peak in the wavelength region ranging between blue violet and near UV").

Regarding claim 9, Maeda, Park and Levinson teach the invention as explained above regarding claim 1, and Maeda further teaches **the phosphor is molded in a periphery of the light emitting chip or on the light emitting chip** (e.g., [0046]; "the near UV LED 1 is sealed within a resin package containing phosphor particles").

Regarding claim 10, Maeda, Park and Levinson teach the invention as explained above regarding claim 1, and Maeda further teaches **the phosphor is manufactured by mixing the phosphor with a light transmitting resin** (e.g., [0046] and [0049]; "a phosphor layer 2 made of a resin including…phosphor particles," "the phosphor layer 2 absorbs the near UV…and converts it into white based light"; NOTE: "Absorbing" and "converting" light is equivalent to "light transmitting").

Regarding claim 11, Maeda, Park and Levinson teach the invention as explained above regarding claim 10, and Maeda further teaches **the resin is an epoxy resin or a silicon resin** (e.g., [0050]; a resin such as an epoxy resin…or a silicone resin…an epoxy resin and a silicone resin are preferred").

Regarding claims 13, 14 and 17, Maeda teaches **a light emitting device** (e.g., [0002]; "a known semiconductor light emitting device") **comprising: a substrate** (e.g., [0046]; "a sub-mount element 7"); **a leadframe** (e.g., [0046]; "a lead frame 8"); **a light emitting chip emitting a light** (e.g., [0002]; "a near UV LED chip having an emission peak in a wavelength region of

near UV"); **a connection part** (e.g., [0046]; "interface mounted") **for electrically connecting the substrate** (e.g., "sub-mount element 7") **with the light emitting chip** (e.g., [0046]; "near UV LED 1 is interface mounted on a sub-mount element 7"; NOTE: Interface mounted is equivalent to "electrically connected."); **a connection part for electrically connecting the leadframe with the light emitting chip** (e.g., [0046]; "a near UV LED is interface mounted on a cup 9 provided on a mount lead of a lead frame 8"); **a phosphor encapsulating and molding the light emitting chip** (e.g., [0046]; "the near UV LED 1 is sealed within a resin package containing phosphor particles") **and through which the light passes** (e.g., [0049]; "the phosphor layer 2 absorbs the near UV emitted by the near UV LED 1 and converts it into white based light"); **a silicate phosphor excited by a light** (e.g., [0028]; "the silicate phosphor is a yellow-based phosphor...that has an excitation peak") **generated by a light emitting chip** (e.g., [0002]; "a near UV LED chip") **and a second phosphor excited by the light generated by the light emitting chip** (e.g., [0023]; "a near ultraviolet light emitting diode [LED chip] for emitting light…and a phosphor layer for absorbing near ultraviolet light emitted by the [LED chip]….the phosphor layer includes…a green-based phosphor…and a yellow-based phosphor"). Maeda fails to teach the chemical formula of the silicate and sulfide phosphors.

In the same field of endeavor of phosphors for use in light emitting diodes, Park teaches **the silicate phosphor has a chemical formula of $Sr_{3-x}SiO_5:Eu^{2+}_x$, $(0 < x \leq 1)$** (e.g., Abstract; "to develop a yellow phosphor that emits efficiently under the 450-470 nm excitation range, we have synthesized a Eu^{2+} -activated Sr_3SiO_5 yellow phosphor"; p. 1647, par. 4; "the yellow emission peaked near 570 nm until 0.15 mol Eu^{2+} concentration"). Park further teaches the luminous efficiency of the silicate phosphor with the above listed chemical formula is better than

other well known yellow phosphors (Park: p. 1649, par 3; "Sr_3SiO_5:Eu developed in this work showed a higher luminous efficiency").

In the same field of endeavor of phosphors for use in light emitting diodes, Levinson teaches **the sulfide phosphor has a chemical formula of $Sr_{3-x}Ga_2S_4:Eu^{2+}$, where $0.001 \leq x \leq 1$** (e.g., col 1, lines 42-44; "the phosphor composition comprises at least one of…$SrGa_2S_4:Eu^{2+}$"; Note: The molar amount of Sr is 1-x and the molar amount of europium is x, as explained in the "Response to Arguments" section above, and therefore the value of x must be between 0 and 1, which is within applicant's claimed range). Levinson further teaches that the emission peak of about 540 nm of the green sulfide phosphor serves to improve the spectral luminous efficacy of the lamp (col 4, lines 42-45).

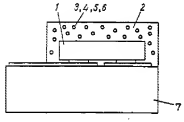
It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Maeda to include the yellow phosphor from Park and the green phosphor from Levinson, because each of the phosphors taught by the secondary references provided improved luminous efficiency over the well known phosphors disclosed by Maeda. The resulting luminous efficiency of the display would therefore increase, creating an improved display with lower power consumption and better picture quality.

Claims 6, 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maeda in view of Park and further in view of Levinson as applied to claims 1 and 14 respectively above, and further in view of Hase et al., USPN 4,631,445, published December 23, 1986 (hereinafter referred to as "Hase").

Regarding claims 6, 15 and 16, Maeda, Park and Levinson teach the invention as explained above regarding claims 1 and 14 respectively, and Maeda further teaches **the light**

emitting device is a top view type (e.g., [0076]; "a surface emitting illumination apparatus"). Maeda also teaches **the light emitting device is a side view type** (e.g., Figure 1; the phosphor layer 2 extends to the edge of the substrate 7 and is therefore capable of being a side view type device). Maeda, Park and Levinson fail to teach the ratio of the phosphors.

FIG. 1



Regarding claim 6, Hase, in the same field of endeavor of light emitting phosphors, teaches **the silicate phosphor and the sulfide phosphor exist at a ratio of 1:1 to 1:9** (e.g., col 4, lines 61-63; "10 to 40% by weight of the silicate phosphor and from 10 to 50% by weight of the...sulfide phosphor"; NOTE: The aforementioned percentages are equivalent to a ratio of 1:1 to 1:5.).

Regarding claims 15 and 16, Hase teaches **the silicate phosphor and the sulfide phosphor exist at a ratio of 1:2 to 1:3** (e.g., col 4, lines 61-63; "10 to 40% by weight of the silicate phosphor and from 10 to 50% by weight of the...sulfide phosphor"; NOTE: The aforementioned percentages are equivalent to a ratio of 1:1 to 1:5.). Hase further teaches **the silicate phosphor and the sulfide phosphor exist at a ratio of 1:3 to 1:4** (e.g., col 4, lines 61-63; "10 to 40% by weight of the silicate phosphor and from 10 to 50% by weight of the...sulfide phosphor"; NOTE: The aforementioned percentages are equivalent to a ratio of 1:1 to 1:5.).

Hase explains that the above listed phosphor ratios provide the benefit of producing white light emission (Hase: col 4, lines 56-63; "in order to obtain a white emitting color…the present invention is selected").

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the two phosphors of the primary references in the ratios taught by Hase, because the above described ratios of silicate phosphor and sulfide phosphor obtain a pure white light emitting color (Hase: col 4, lines 56-63; "in order to obtain a white emitting color…the present invention is selected"). The purpose of the invention disclosed in the primary prior art reference, Maeda, is to produce a white light emitting device. Thus, reconstruction is desirable as taught by the prior art references.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Fouassier, mentioned in the "Response to Arguments" section above, is cited as support for examiner's position regarding europium substitution in phosphor compounds.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MARY ELLEN BOWMAN whose telephone number is (571) 270-5383. The examiner can normally be reached on Monday-Thursday, 7:30 a.m.-6:00 p.m. EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimesh Patel can be reached on (571) 272-2457. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/M. B./
Examiner, Art Unit 2879

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Supervisory Patent Examiner, Art Unit 2879